Traffic Signal Safety

Analysis of Red-Light Running in Maine

FINAL REPORT

TECHNICAL REPORT

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ABSTRACT

The aim of this report is to suggest how to make signalized intersections safer, in particular in respect to crashes caused by red-light violations. The report includes a review of literature, analysis of crashes, and interviews with Maine drivers. One conclusion is that the drivers are completely unaware that there was a red light in about a quarter of the crashes caused by red-light running violations. One way of improving the safety of the location may be to replace it with a modern roundabout. Another conclusion is that signalized intersections should be vehicle actuated if possible or else coordinated with nearby signals. More enforcement by police or automatic surveillance is by the public considered the most effective ways to reduce red-light running. Finally, the most important factor in reducing red-light running frequency, as well as the number of serious crashes caused by red-light running, is never having a posted speed limit greater than 35 mph through a signalized intersection.

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EXECUTIVE SUMMARY

Traffic Signal Safety—Analysis of Red-Light Running in Maine

Introduction

This three-page Executive Summary highlights some of the findings of this study. A 12-page more detailed summary starts on page **Error! Bookmark not defined.**. The main text of the report giving additional information to the interested reader starts on page **Error! Bookmark not defined.**.

The primary objective of this project is to inform Maine Department of Transportation and the public of how red-light running contributes to crashes at signalized intersections in Maine. Studies by the Insurance Institute for Highway Safety (IIHS) indicate that the safety of signalized intersections has deteriorated because of an increasing number of drivers running red lights. IIHS did not include Maine in their studies.

The first part of the project was to conduct a literature review which included over 80 documents. Among the findings of this review is that red light running crashes in the U.S. cause the death of about 1,000 people and close to 100,000 injuries each year. The literature review discusses the effect of traditional enforcement as well as of automatic surveillance. It also covers the effect of Intelligent Transportation System technologies, conventional technologies, strobe lights, light emitting diodes, advance warning signs, exclusive left-turn phasing, longer evacuation times, vehicle actuation, and signal coordination.

Crash-Data Analysis

Official statistics provided by Maine Department of Transportation (MDOT) show that there were 10,169 reported crashes at signalized locations in Maine in the three-year period from 1999 to 2001. Of these, 4203 (41.3%) were classified as intersection-movement crashes, whereas 5325 (52.4%) were classified as rear-end. Of the intersection-movement ones, 2611 were identified as left-turn crashes. The crashes caused six fatalities, 277 incapacitating injuries, 1461 evident injuries, and 3115 possible injuries. Three out of the six people who were killed were unprotected road users; one was a pedestrian, one a bicyclist and one a motorcyclist. The pedestrian and bicyclist disregarded the traffic-control device. The motorcyclist collided with a vehicle making a left turn. One more person was killed in a left-turn collision where both parties entered on green 'balls.' Finally, two people were killed at high-speed locations where the parties had perpendicular through courses and one of them ran a red light. There were no fatal rear-end crashes.

Fatal and Incapacitating Red-Light Running Crashes

There were 76 fatal and incapacitating injury crashes that involved red-light running vehicles. The actual police reports were analyzed for these. Two thirds of the drivers disregarding the signal were men. This roughly reflects the mileage driven by men and women respectively. An analysis by age shows that people below age 25 and above age 70 are overinvolved in red-light running crashes.

Bicyclists and pedestrians frequently are at fault in crashes at signalized intersections. On the other hand, motorcyclists seem to be following traffic-control devices in exemplary ways, even if that does not prevent them from being injured in these crashes. A surprising finding is that drivers of pickup trucks are much more likely to run red lights than drivers of passenger cars.

A crash-time analysis shows it was daylight in 82% of the crashes and dark with streetlights lit in 15%. The roadway was dry in 85% of these serious crashes, wet in 14% and covered by snow or ice in 1%. About 10% of the crashes occurred at locations with a speed limit of 45 mph or higher, 42% of them on 25 mph streets and the remaining 48% on 30 to 40 mph-streets.

An analysis by town shows that the communities with the highest per capita frequency of serious injury crashes caused by red-light running are Auburn (6.9 per 10,000 people), Lewiston (3.6), Winslow (2.6), Bangor (2.5), Saco (2.4) and Presque Isle (2.1).

Observations of Red-Light Running

The overall frequency of red-light running is, in the literature, reported to vary with location from a low of around 0.05% to a high around 3.9%. Observations from 15 intersections around Maine are all within this range—varying between 0.1% and 1.3% if dividing the number of through vehicles entering on red by the total number of entering through vehicles. The percentages would be much higher if right-turning vehicles were included. The highest observation was found on a 4-lane, high-speed road in a rural setting (Route 202 through Manchester) whereas the lower percentages typically were found in lower-speed, urban environments.

Calculating the red-light running frequency as a percentage of those arriving during red, gives observations from 0.2% to 5.1%. The percentage running the light of those arriving as first vehicle after the signal turned red varied between 0.3% and 18%. If observing only those drivers that arrive within the first two seconds of red, an even higher percentage ran the light, between 3 and 97%.

Interviews with Maine Drivers

During 2002 and 2003, 334 completed surveys of people in Maine were collected by students.

People were asked what they typically do when approaching a signal that is changing so that it would become red just when they got to the stop line, if they proceeded with unchanged speed. A majority of drivers said they would slow down and stop but a majority of younger drivers would speed up in this situation. Only a very small minority of drivers admit to running a light which is clearly red before they get there.

People were asked if they could recall having run any red lights in the last 12 months. Over 75% of drivers below age 25 admit to this whereas only 38% of drivers 50 or older admit to it. In reality, people may have run lights more than they remember/admit to.

About 31% of people admit to knowingly[1] having run the 'latest' signal they entered on red while 43% claim they did it by mistake[2] and 11% say they became aware of the red signal so late that they did not have the option to stop. Finally, 7% say they were completely unaware that they had run the red light until they afterwards were told

[1] They knew the light probably would change to red before they entered.
[2] The light changed to red quicker than expected.

by a passenger (or police officer) that they had done so. This last category would be underreported since many people would have no passenger telling them about it.

People were asked if they have been stopped by police for running a red light and 34 of the 334 people participating in the survey admit to this.

People were asked what they think could be done to have *other* people run red lights less frequently. Five fixed alternatives were offered besides a fill-in line. Among the fixed alternatives, *photo enforcement* was the most favored with 44% supporting it followed by *longer yellow times* with 36%, *more police enforcement* with 35%, *shorter red times* with 20%, and *television information about risk of running red lights* with 15%.

The next question addressed what we can do to have the interviewee himself/herself run red lights less frequently. It was an open question with no given alternative answers. Again, most people suggested that enforcement, either through photo enforcement or more police on the streets, would be the most effective way of having them run fewer lights.

A total of 41 interviewees had been involved in crashes at signalized intersections as a driver (29 people) or passenger (12). Sixteen of the 41 people involved in crashes were occupants (typically the driver) of the vehicle running a red light. In three of these cases (19%), the driver misjudged the timing and thought it would not change to red so quickly. In two cases (13%) the driver was unaware that the signal had changed to red. In one case (6%), the driver was completely unaware that there was a signalized intersection, and in another case (6%) the driver did not see the signal since it was blocked by a truck.

Conclusions and Discussion

If we want to reduce the number and severity of crashes involving drivers running red lights, we need to do one or more of the following:

- reduce drivers' need to stop
- increase the likelihood drivers will stop
- reduce the likelihood of a (serious) crash if a driver runs a red light.

One way to achieve the goal of reducing drivers need to stop is to reduce the number of signalized intersections. Spontaneously, ten people suggested that we should have fewer signalized intersections and another three people suggested that signals go to flashing operation at night. Also in the survey, three people suggested that signals be better coordinated. Coordination of signals can significantly reduce the number of drivers facing a red light if it is done well. As indicated in the literature review, vehicle actuation is an alternative way to reduce the percentage of people facing a yellow or red light.

There are different ways to increase the likelihood drivers will stop for red lights. People in Maine believe that photo enforcement would be more effective than any other measure. The 'second' most effective way is a tie between 'longer yellow times' and 'more frequent police enforcement.

The driver was unaware that there was a red light (or even a signal) in four of the 16 crashes where the interviewee ran the red light. If, on average, 25% of all red-light

running crashes have that characteristic, then improving signal visibility and conspicuity obviously could improve the safety dramatically.

Speed more than anything else determines the extent of injuries in a crash. Also, crashes are less likely to occur if all parties drive slowly. A conclusion one can draw from this study is that the posted speed should never exceed 35 mph at signalized approaches. Besides speed, the angle of collision is important in explaining injury outcomes to occupants of motor vehicles. Side impacts at a given speed are more serious than rear-end or head on collisions, though head-on collisions should always be avoided since the relative speed of the parties typically is very high. Separate, protected left-turn phasing is an important tool in reducing the number of side impacts as well as head-on collisions. We ought to also make sure that signalized intersections are safe for pedestrians, bicyclists and motorcyclists since a high portion of fatalities involve these categories.